

last two years, it is most probable that the disruption of these masses of ice from the place of their formation was the effect of some powerful cause of rare occurrence, such as an earthquake or volcano, which has burst forth and convulsed the inaccessible regions of the south; leaving no other testimonials of the event, than some few fragments of ice, scattered at a distance in the Indian Ocean.

On the progressive Improvements made in the Efficiency of Steam Engines in Cornwall; with Investigations of the Methods best adapted for imparting great angular Velocities. By Davies Gilbert, Esq. P.R.S. Read March 4, 1830. [*Phil. Trans.* 1830, p. 121.]

The practical adaptation of the steam-engine to mechanical purposes is considered by the author as due to Mr. Newcomen, whose engines were introduced into Cornwall very early in the last century, and soon superseded the rude machinery which had till then been employed for raising water from the mines by the labour of men and of horses. The terms proposed by Mr. Watt, in virtue of his patent in 1769, which secured to him, until the year 1800, the receipts of one third of all the savings in fuel resulting from the adoption of his improvements in the construction of the engine, rendered it necessary to institute an accurate comparison between the efficiency of his with former engines. A copy of the report drawn up on this occasion, in October 1778, is given in the paper; but as the dynamic unit of one pound avoirdupois, raised through a height of one foot, had not yet been established as the measure of efficiency, the author, proceeding upon the data furnished by that report, calculates that the duty performed by Watt's engine, with the consumption of one bushel of coal, on that occasion was 7,037,800. In the year 1793, an account was taken of the work performed by seventeen engines on Mr. Watt's construction, then working in Cornwall, their average duty was 19,569,000; which exceeds the performance of the former atmospheric engines, in the standard experiments, in the proportion of 2.78 to 1. Some years afterwards, disputes having arisen as to the real performance of Mr. Watt's engines, the matter was referred to five arbiters, of whom the author was one; and their report, dated in May 1798, is given as far as relates to the duties of the engines. The general average of twenty-three engines was 17,671,000. Since that period, so great have been the improvements in the economy of fuel and other parts of the machinery, that in December 1829, the duty of the best engine, with a cylinder of 80 inches, was 75,628,000, exceeding the duty performed in 1795, in the proportion of 3.865 to 1; and that of the atmospheric engine of 1778, in the proportion of 10.75 to 1.

The remainder of the paper relates to the friction in machinery, and the different modes of obviating its effects. With a view of reducing the amount of friction, the author is led to consider what are the most proper forms for the teeth and cogs of wheels; and through what intermediate steps a given increase of angular velocity may be

most advantageously communicated. Equability of velocity is obtained, though at the expense of some degree of sliding friction, when the outline of the teeth of the wheels are involutes of circles. Friction, on the other hand, is wholly prevented when their form is the logarithmic spiral; but the angular velocities will then be variable. Hence these two advantages are incompatible with one another; but on the whole, the author gives the preference to the involute, which produces an equability of angular motion. The most advantageous mode of increasing velocity by a series of wheels is to adjust them so that the multiplication of velocity shall proceed in a geometrical progression.

On the Laws of the Polarization of Light by Refraction. By David Brewster, LL.D. F.R.S. L. & E. Read February 25, 1830. [*Phil. Trans.* 1830, p. 133.]

M. Arago had deduced from some experiments which he made on the polarization of light with plates of glass, that the quantity of light polarized by reflexion is equal to the quantity polarized by transmission, whatever be the angle of incidence. The author of the present paper shows that the views from which this deduction was made, and the observations on which they are founded, are incorrect. By applying to the subject the same principles which he has already developed in the paper lately read to the Society, on the Polarization of Light by Reflexion, he establishes, on the basis of actual experiment, what he conceives to be the true laws of the phenomena. The first step in his inquiry is the determination of the law according to which the polarizing force of the refracting surface changes the position of the planes of polarized light. He shows that when a compound pencil, of which the constituent rays are polarized in planes inclined at angles of 45° , the one being to the right and the other to the left of the plane of refraction, is refracted, the planes of polarization of the refracted rays are turned so as to approach to coincidence, not in a plane parallel to the plane of reflexion, as happens in the reflected rays, but in a plane at right angles to it. This contrariety of effect, he observes, is exactly what might have been expected from the opposite character of the resulting polarization, the poles of the particles of light, which were formerly repelled by the force of reflexion, being now attracted by the refracting force. The author next endeavoured to ascertain the influence of refracting power in effecting polarization, but experienced great difficulty in prosecuting this inquiry, from the necessity of having plates without any crystalline structure. He tried gold leaf in a variety of ways, but found it almost impossible to obtain correct results, on account of the light which was transmitted unchanged through its pores. From observations with films of soapy water, and thin plates of metalline glass of high refractive power, he concludes that the rotation of the planes of polarization increases with the refractive power. By an examination of the effects produced at different angles of incidence, he deduces